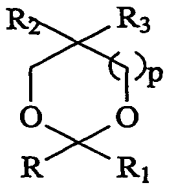
Claims

What is claimed is:

1. A method for analysis of a small molecule comprising contacting a sample containing at least one small molecule with a surfactant represented by the formula:



in which
p is 0, 1 or 2;
R is alkyl;
R_1 and R_2 are each, independently, hydrogen or methyl; and
R_3 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,
wherein R_4 and R_5 are each, independently, lower alkyl; to thereby analyze the small molecule.

2. The method of claim 1, wherein the sample is a biological sample.

3. The method of claim 2, wherein the biological sample comprises one or more cells.

4. The method of claim 3, wherein the biological sample comprises a tissue culture.

5. The method of claim 3, wherein the biological sample comprises a biological fluid, a biological tissue, a biological matrix, an embedded tissue sample, a cell culture supernatant, or combination thereof.

6. The method of claim 2, wherein the analysis comprises lysis of the cell.

7. The method of claim 2, wherein the analysis comprises clarification

8. The method of claim 2, wherein the analysis comprises clarification of tissue culture supernatant.

9. The method of claim 2, wherein the analysis comprises dissociation of a small molecule from a biological matrix.

10. The method of claim 2, wherein the biological fluid is selected from the group consisting of blood, blood plasma, urine, spinal fluid, mucosal tissue secretions, tears, interstitial fluid, synovial fluid, semen, and breast milk.

11. The method of claim 1, wherein the analysis comprises isolation of the small molecule.

12. The method of claim 1, wherein the analysis is selected from the group consisting of solid phase extraction, solid phase micro extraction, electrophoresis, mass spectrometry, liquid chromatography, liquid-liquid extraction, membrane extraction, soxhlet extraction, precipitation, clarification, electrochemical detection, staining, elemental analysis, Edmund degradation, nuclear magnetic resonance, infrared analysis, flow injection analysis, capillary electrochromatography, ultraviolet detection, and combinations thereof.

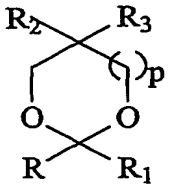
13. The method of claim 1, wherein the small molecule is selected from the group consisting of a drug, a prodrug, a metabolite of a drug, and a product of a reaction associated with a natural biological process.

14. The method of claim 1 wherein the analysis comprises high performance liquid chromatography.

15. The method of claim 1 wherein the analysis comprises solid phase extraction.

16. The method of claim 1 wherein the analysis comprises mass spectrometric detection.

17. A method for performing cell lysis comprising contacting a cell containing at least one small molecule with a surfactant represented by the formula (Formula I):



in which
p is 0, 1or 2;
R is alkyl;
R_1 and R_2 are each, independently, hydrogen or methyl; and
R_3 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,
wherein R_4 and R_5 are each, independently, lower alkyl;
to thereby lyse the cell.

18. The method of claim 17 comprising the further step of degrading the surfactant after cell lysis.

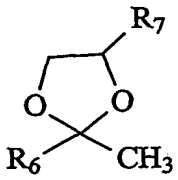
19. The method of claim 18 wherein the step of degrading the surfactant after cell lysis comprises contacting the surfactant with an acidic solution.

20. The method of claim 18 comprising the further step of isolating the small molecule.

21. The method of claim 20 comprising the further step of purifying the small molecule.

22. The method of claim 20, wherein the purification step is accomplished by solid phase extraction or HPLC.

23. The method of claim 17 wherein the surfactant is represented by the following formula:

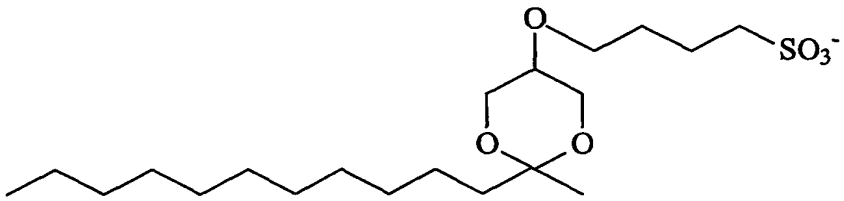


in which

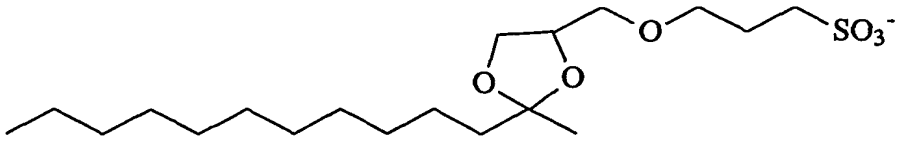
R_6 is alkyl;

R_7 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$, wherein R_4 and R_5 are each, independently, lower alkyl.

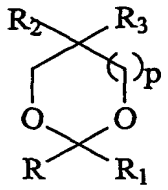
24. The method of claim 17 wherein the surfactant has the following chemical structure:



25. The method of claim 17 wherein the surfactant has the following chemical structure:



26. A kit for performing cell lysis on a cell containing at least one small molecule comprising:
a surfactant represented by the formula:

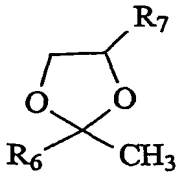


in which
p is 0, 1 or 2;
R is alkyl;
R_1 and R_2 are each, independently, hydrogen or methyl; and
R_3 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,
wherein R_4 and R_5 are each, independently, lower alkyl; and instructions for use.

27. The kit of claim 26 further comprising a solution for degrading the surfactant.

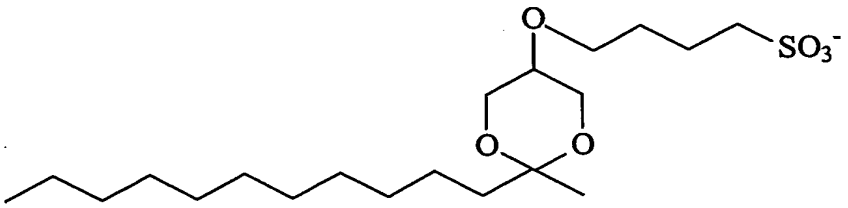
28. The kit of claim 26 further comprising a solid phase extraction device.

29. The kit of claim 26 wherein the surfactant is represented by the following formula:

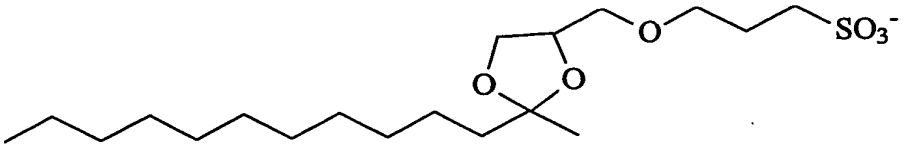


in which
R_6 is alkyl;
R_7 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,
wherein R_4 and R_5 are each, independently, lower alkyl.

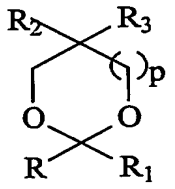
30. The kit of claim 26 wherein the surfactant has the following chemical structure:



31. The kit of claim 26 wherein the surfactant has the following chemical structure:



32. A method for eletrophoretically isolating a small molecule from a sample comprising contacting a sample containing at least one small molecule with a surfactant represented by the formula (Formula I):



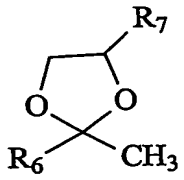
in which
p is 0, 1or 2;
R is alkyl;
R_1 and R_2 are each, independently, hydrogen or methyl; and
R_3 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,
wherein R_4 and R_5 are each, independently, lower alkyl;
to form a sample/surfactant complex,
performing electrophoresis on the sample/surfactant complex,
to thereby electrophoretically isolate the small molecule.

33. The method of claim 32 comprising the further step of degrading the surfactant after electrophoresis.

34. The method of claim 33 wherein the step of degrading the surfactant after electrophoresis comprises contacting the surfactant with an acidic solution.

35. The method of claim 33 comprising the further step of purifying the small molecule.

36. The method of claim 32 wherein the surfactant is represented by the following formula:

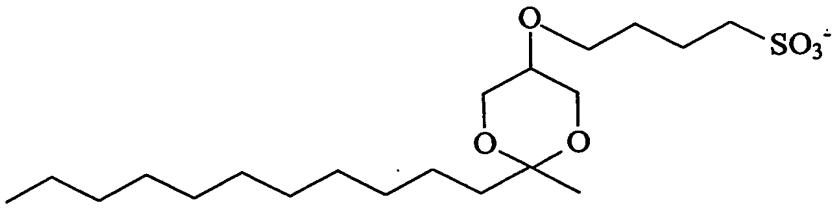


in which

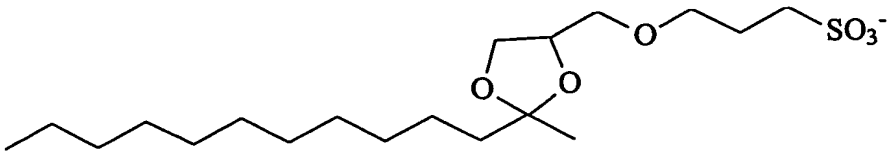
R_6 is alkyl;

R_7 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$, wherein R_4 and R_5 are each, independently, lower alkyl.

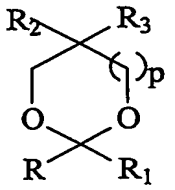
37. The method of claim 32 wherein the surfactant has the following chemical structure:



38. The method of claim 32 wherein the surfactant has the following chemical structure:



39. A kit for performing electrophoresis on a sample containing at least one small molecule comprising:
a surfactant represented by the formula:



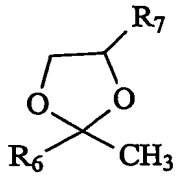
in which
p is 0, 1 or 2;
R is alkyl;
R_1 and R_2 are each, independently, hydrogen or methyl; and
R_3 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,
wherein R_4 and R_5 are each, independently, lower alkyl; and instructions for use.

40. The kit of claim 39 further comprising a solution for degrading the surfactant.

41. The kit of claim 39 further comprising a molecular weight standard.

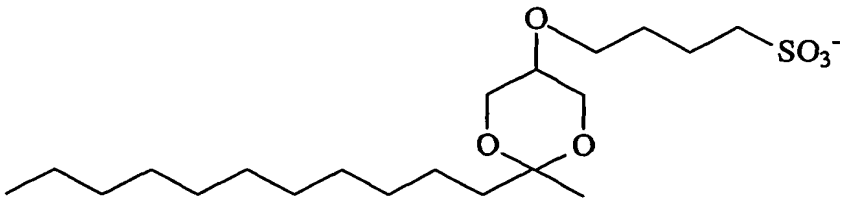
42. The kit of claim 39 further comprising a staining reagent.

43. The kit of claim 39 wherein the surfactant is represented by the following formula:

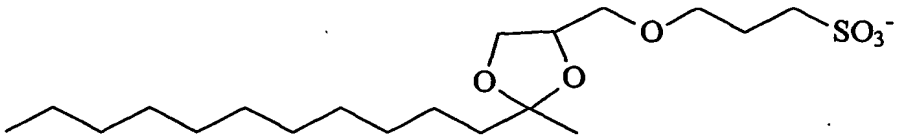


in which
R_6 is alkyl;
R_7 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,
wherein R_4 and R_5 are each, independently, lower alkyl.

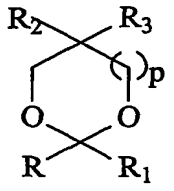
44. The kit of claim 39 wherein the surfactant has the following chemical structure:



45. The kit of claim 39 wherein the surfactant has the following chemical structure:



46. A method of solubilizing a small molecule comprising contacting a sample containing at lease one small molecule with a surfactant represented by the formula (Formula I):



in which

p is 0, 1or 2;

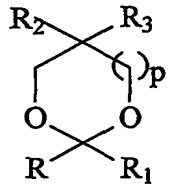
R is alkyl;

R_1 and R_2 are each, independently, hydrogen or methyl; and

R_3 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,

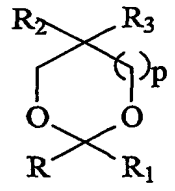
wherein R_4 and R_5 are each, independently, lower alkyl; to thereby solubilize the molecule.

47. A method of regenerating a liquid chromatography column having a sorbent to which is bound at least one small molecule comprising contacting the sorbent with a surfactant represented by the formula (Formula I):



in which
p is 0, 1or 2;
R is alkyl;
R_1 and R_2 are each, independently, hydrogen or methyl; and
R_3 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,
wherein R_4 and R_5 are each, independently, lower alkyl
such that the small molecule bound to the sorbent is removed, thereby regenerating the column.

48. A method for analyzing a small molecule contained in a cell comprising:
contacting the cell with a surfactant represented by the formula (Formula I):



in which
p is 0, 1or 2;
R is alkyl;
R_1 and R_2 are each, independently, hydrogen or methyl; and
R_3 is selected from $-OSO_3^-$, $-R_4OSO_3^-$, $-R_4OR_5SO_3^-$, and $-OR_5SO_3^-$,
wherein R_4 and R_5 are each, independently, lower alkyl; to lyse the cell; and
analyzing the small molecule.

49. The method of claim 48, wherein the step of analyzing comprises mass spectrometry.

50. The method of claim 48, wherein the step of analyzing comprises electrophoresis.

51. The method of claim 48, wherein the small molecule is propranolol.